A VIBRATING AGGREGATE

Technical Field

~~The invention concerns a vibrating aggregate according to the preamble of claim 1.~~

The invention relates to vibrating aggregates used in devices to be vibrated (typically in vibrating feeders and vibrating screens). A vibrating aggregate includes an eccentric mass whereby the screen basket or the feeder body connected to the aggregate and lying on springs begins to move by the influence exerted by the eccentric mass when the eccentric mass is rotated. When using one eccentric mass the movement of the screen or the feeder has the form of a circular orbit. When using two rotating eccentric masses mechanically coupled to each other a linear impact motion is produced, its direction being changeable by changing the phase difference between the rotation of the eccentric masses. The length of the impact motion or stroke can be adjusted by adjusting the size of the eccentric masses.

Background Art

FR 2 668 960 discloses one well-known aggregate type. The aggregate shown in figure 1 thereof, representing the prior art, consists of a continuous connecting shaft driven by a pulley coupled thereto. Eccentric weights are coupled to the shaft by a cotter joint. The eccentric weights are provided with additional weights so as to increase the force of the vibration (i.e. the length of the stroke). The aggregate body and the bearing housings of the bearings of the connecting shafts are fixed to the side plate of the screen basket/feeder body by a screw joint.

An aggregate like this is large and therefore cumbersome. Because screens/feeders often work in a dusty environment, the aggregate, when it is serviced or repaired (when a bearing is changed, for example), has to be opened so that its oil chamber becomes exposed to dust and dirt. In vibratory use, the cleanliness of oil is even more crucial than usually as far as the service life of the bearings is concerned.

The same publication discloses an aggregate type developed to solve the problems with the earlier aggregate type. In the improved solution the connecting shaft is composed of separate sections connected to each other. The sections of the shaft are connected to each

other by cotter or pin couplings (figures 2 and 7) or by articulated joints (figure 9) transmitting torque moment - but not bending moment. The joint between them is easy to dismount. The advantage of this technique is that the bearing combination at each end of the connecting shaft is separately detachable from the aggregate, together with the bearing housing and the oil chamber connected thereto. Consequently, the bearing arrangement can be serviced and repaired detached from the screen/feeder in a repair shop. Similarly, the spare parts service is easier because the change of parts does not take much time and the assembly of the aggregate part to be changed can be finished in workshop conditions to such an extent that the inconveniences caused by the difficult circumstances under the final mounting are controllable. Besides, the aggregate is easier to handle because it can be disassembled into smaller sections.

However, the aggregate presents a problem in that the technical realization of the bearing arrangement is more difficult. The connecting shaft being no longer rigid, both shaft ends have to be supported by two successive bearings, on both sides of the side plate, so that they can take the bending moment. Consequently, the bearings lie at a short distance from each other, which makes the aggregate very critical to the placement of the vibrating masses. Therefore, it has been necessary to divide the vibrating weight into equal parts accurately on both sides of the side plate to balance the force applied to the bearings. When it is desired to adjust the length of the impact motion or stroke of the screen/feeder, it is necessary to connect additional weights to both eccentric weights, or, at least to change the axial position of one weight as the mass of the other weight increases. If this is not done, the bearing arrangement is subjected to a bending moment which stresses the bearings unevenly so that they wear out earlier.

Because of the above, solving of the problems with the earlier aggregates in the way proposed in FR 2 668 960 has caused the aggregate structure to become radically more complicated and the production costs to increase.

Disclosure of Invention

A vibrating aggregate according to claim 1 has now been invented. ~~In a vibrating~~ aggregate according to the invention ~~the joint between~~ the shaft sections is rigid and ~~without a clearance, and it transmits not only torque moment but also bending moment.~~

The advantage of the rigid shaft joint is that the aggregate can be mounted on the side plate of the screen basket/feeder body by means of one self-aligning bearing. In addition to the advantages of the earlier solutions (ease of disassembling and serviceable from outside of the screen basket/feeder body without having to open the oil chamber at the site, ease of handling), an aggregate according to the invention presents, for example, the following advantages:

- Cost savings resulting from the simple structure (no complicated articulated shaft, less bearings).
- The same basic aggregate can be used for different kinds of vibrating devices because it is easy to adjust. Hence it can be manufactured in large series and at low production costs.
- The bearings last long because the bearing loads are even and the misalignments of the shafts are insignificant.

Brief Description of Drawings

The invention and the details thereof will be described in the following text with reference to the enclosed drawings wherein

Figure 1 is a longitudinal section of an aggregate according to one embodiment of the invention,

Figure 2 is an enlarged view of the joint and the vibrating aggregate module used in the aggregate of figure 1,

Figure 3 is a longitudinal section of an aggregate according to another embodiment seen from above,

~~Figures 4 – 7 show different joint alternatives seen from the side and from the end of the shaft.~~

Modes for Carrying Out the Invention

In a vibrating aggregate of a modular construction according to the invention, a connecting shaft 1 is connected to module shafts 2 by a joint without a clearance, transmitting both torque and bending moment. Preferably, this joint is a cone joint which in itself is known, for example, from machine tools as a way of connecting tools. A vibrating aggregate module shown in figure 2 forms an entity easily detachable from the device to be vibrated. The cone joint surface tapering towards that end of both module shafts which is connected to the connecting shaft is denoted by reference number 3. Both ends of the connecting shaft have corresponding cone-shaped recesses where the cone of the module shaft can be inserted. The cone angle of the cone joint has to be big enough so that it does not make the joint self-locking and difficult to dismount.

The aggregate is mounted on a side plate 4 of the screen basket/feeder body by one self-aligning spherical bearing 5. Both module shafts are fastened to the connecting shaft by an axial fixing screw 6 extending from the outer end of the module shaft to the connecting shaft through the cone. Furthermore, the cone is mounted to the connecting shaft by means of a pronged locking piece 15 or in another corresponding way of mounting so as to position the module shaft and the connecting shaft in the right position in relation to each other.

A bearing housing 10 functions as a module body and has a cover 11. A sealing ring 12 seals the cover against the module shaft. An oil chamber 13 is connected to the bearing and is sealed against the sealing locking piece 15 by a sealing 14. A sealing 14' is located between the cover 11 and the sealing ring 12. A protecting cover 16 fastened to the side plate 4 protects eccentric weights and a protecting tube 17 protects the connecting shaft.

The vibrating aggregate is driven by a suitable drive mechanism and transmission, for example by a V-belt drive. A pulley 18, located at the end of the other module shaft, is shown in the drawings.

The eccentric weights can be joined to the aggregate in different ways. The eccentric mass can be a separate eccentric weight 7 mounted on the module shaft so that the connecting shaft 1 does not have to be eccentric. The entire eccentric mass can also be placed on

the connecting shaft whereby the connecting shaft does not function only as a transmission shaft but also as an eccentric weight. Thus, the connecting shaft can, for example, be machined eccentric as shown in the drawings.

In the drawings a combination of the eccentric mass arrangements described above is shown, wherein the eccentric mass is placed not only on the connecting shaft 1 but also on the separate eccentric weights 7 fastened to the module shaft 2. Preferably, the centre axis of the connecting shaft is eccentric in the same direction as the eccentric weights 7 in relation to the module shafts. Thus, the connecting shaft and the eccentric weight compensate the misalignment of the module shaft, caused by the eccentricity of each other, at the bearing. This is of great importance as far as the warming-up and the service life of the bearing are concerned.

In addition, the aggregate is easier to adjust than aggregates having a connecting shaft connected by an articulated or flexible joint: additional weights 8, 9 can be joined to the module shaft in order to adjust the length of the impact motion or stroke of the device to be vibrated without stressing the bearing arrangement significantly because the bending moment caused by the additional weights to the module shaft 2 is transmitted to the connecting shaft 1 by means of the rigid shaft joint and the bending moment is not received by the bearing arrangement. Thus, no compensating weights need to be added on the shaft part between the bearings, and the aggregate can be adjusted by operating entirely outside the screen basket/feeder body.

Preferably, the extra weights 8, 9 are joined to the eccentric weights 7.

When using a cone joint between the connecting shaft and the module shafts, the advantage is obtained that in order to connect the shafts to each other one axial screw 6 reachable from the end of the aggregate is sufficient.

An aggregate according to the invention is, as shown in figure 3, can also be used for two-shaft use wherein two aggregates are coupled to each other by a gear transmission 19 in order to direct the impact motion of the aggregate to be vibrated.

The embodiments described above are to be considered not restrictive in character, the spirit and scope of the invention being limited solely by the appended claims. It is also pos-

sible to place the cone of the cone joint at the end of the connecting shaft. In that case the module shaft has a corresponding recess. Alternatives to the joint between the shaft sections are shown in figures 4 – 7. The cone joint can be replaced by a pyramid joint (figure 4) having a square-shaped cross-section instead of the circular cross-section of a cone. Furthermore, the joint can be composed of different kinds of prongs or flanges (figure 7).

An aggregate according to the invention can be used not only in vibrating feeders and conveyors and vibrating screens but also in other kinds of vibrating devices, such as in vibrating devices and vibrating rollers for compression of masses.